In addition, on pages 4-5 of the Office Action, claims 1, 5, 7, 8, 10-17 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Haars and Conradie, in further view of Schneider et al.

Basically, the Examiner cites Haars as disclosing wood binding compositions suitable for binding wood chips together to make particle board comprising lignin or lignin sulfonate and laccase or catechol oxidase or peroxidase in an aqueous solution. *See* col. 2, line 5 to col. 4, line 2. The Examiner cites Conradie as disclosing that metal soaps of long chain unsaturated fatty acids such as oleic and linoleic acids act as superior wood preservative agents. *See* col. 1, lines 43-64. The Examiner asserts that Conradie discloses that the wood preservative compositions may contain any known insecticide and/or fungicide, such as pyrethroid, a carrier media such as xylene, and emulsifiers. *See* col. 2, lines 21-39. Thus, the Examiner takes the position that one of ordinary skill in the art would have been motivated to add known wood preserving agents to the wood binder of Haars to confer improved properties.

In addition, the Examiner cites Schneider as disclosing numerous compositions for various applications comprising an enzyme that may be a laccase, catechol oxidase, bilirubin oxidase from Myrothecium, or monophenol monooxygenase. *See* page 19, line 1-27. The Examiner takes the position that one of ordinary skill in the art would have been motivated to use the bilirubin oxidase of Schneider in the composition of Haars because of the reasonable expectation that Schneider's bilirubin oxidase would have been useful to polymerize the lignosulfonate based on Schneider's disclosure of the polymerization of chemically similar lignin.

Applicants respectfully respond as follows.

The present invention relates to obtaining preserved wood products by impregnating a

lignin or ligninosulfate into a wood material, which is a porous substance, with an enzyme having polyphenol oxidizing activity. The composition for such a treating liquid is one of so-called "wood preservatives for pressure treatment". The wood treated with such a wood preservative is called "pressure treated wood", which is a completely different product from wood processed by a bonding treatment.

Haars relates to a process for producing an active binder for wood products, specifically particle boards, and Schneider relates to a technology intended for wood composites, specifically chipboards, fiber boards, particle boards or laminated wood products. In contrast, the present invention aims at producing pressure treated wood and preserving it, and is intended mainly for solid wood. Therefore, the object of the present invention is completely different from that of Haars or Schneider, as is the aimed product, and the field of art (technology) of the present invention differs from that of Haars and Schneider.

In addition, the properties required for the wood preservatives for pressure treatment are different from those for an adhesive agent. The pressure treated wood is produced by impregnating the treating liquid from the surface of the wood under pressure or reduced pressure and then drying the wood. The thus-obtained wood has a layer on its surface wherein the treating liquid is impregnated, which works to protect the wood from wood rotting fungi, termite and rain water. The pressure treated wood is appropriately cut and processed to be used for a foundation of houses and outdoor wood-products.

The properties required for the wood preservatives for pressure treatment are as follows:

1. To have good permeability into wood. Accordingly, the viscosity of the treating liquid should be sufficiently low.

2. Detailing the particulars of 1 above, as the liquid for pressure treatment is recovered and repeatedly used, it is required to not cause polymerization or an increase in viscosity while reserved in a container, which may lead to deterioratation of the permeability of the liquid into wood. The pressure treatment is repeatedly performed by replenishing the treating liquid in an amount lost by impregnation into wood. As a result, part of the liquid is reserved for quite a long time before use and, therefore, is required to maintain the permeability.

3. Moreover, wood products such as a board, log and timber are pressure treated in a stacked status and dried as they are after the treatment, then shipped and used. Thus, an increase in the viscosity of the treating liquid may incur a problem that the stacked wood products are bonded to each other.

In contrast to the above, an adhesive agent is required to have a relatively high viscosity and further a rapid increase in viscosity. Haars describes that "various sulfite spent liquors and pure sodium lignin sulfonate were slowly stirred... until the suspension reached the consistency of honey" (2. Producing the binder). Such properties required for an adhesive agent are completely different from those for a wood preservative for pressure treatment, and the present invention solves different technological problems.

As mentioned in 2 above, when a solution of an adhesive agent is recovered and repeatedly used, it causes generation of insoluble matters and increase of the viscosity. Thus, conventional technology using an adhesive agent was not available for pressure treatment and extensive studies were performed on achieving a method to sufficiently stabilize the treating liquid before use in pressure treatment to arrive at the present invention.

Further, as mentioned in 3 above, using a conventional adhesive agent with stacked wood products causes a problem that the stacked wood products become bonded with each other, and such problem needed to be solved, as well. It is difficult to solve the problem by merely diluting the adhesive agent with water. The solution of the adhesive agent exudes from

inside of wood products during a drying step after pressure treatment and generates a thicker solution on the surface of the wood, which results in bonding of the wood products to each other.

Accordingly, the problems noted above, were solved by the present invention, i.e, impregnating ligninosulfate into wood materials with an enzyme having polyphenol oxidizing activity and performing polymerization by providing oxygen during a drying period of the wood. In this regard, the present specification discloses that: "...since the enzymatic macromolecularization reaction proceeds mainly in the inside of the porous article, a large amount of treatment liquid can be impregnated with ease by using the treatment liquid in a state where the substance constituting the reaction composition has a low molecular weight and, hence, a relatively low viscocity."

Schneider and Haars describe the idea of polymerization using ligninosulfate and an enzyme having polyphenol oxidizing activity but only for use as an adhesive agent.

In view of the above, it is quite difficult for one of ordinary skilled in the art to expect that applying the combination of ligninosulfate and an enzyme having polyphenol oxidizing activity would result in excellent wood preservatives for pressure treatment and that various problems that cannot be solved with ordinary adhesive agent could be solved. Schneider and Haars do not teach or suggest application of the above combination to wood preservatives for pressure treatment nor do they teach or suggest that the application can solve the problems mentioned in above 1, 2 and 3.

As noted above, the method of the present invention comprises impregnating ligninosulfate into wood materials with an enzyme having polyphenol oxidizing activity and

performing polymerization by providing oxygen during a drying period of the wood enables impregnatation of the solution in a state where the solution has a relatively low molecular weight of ligninosulfate content and hence, a low viscosity, into wood. Such polymerization hardly proceeds while the treating liquid is reserved in a container because oxygen is provided at an extremely low rate, which always allows provision of a treating liquid with low viscosity. That is, even if the treating liquid of the present invention is repeatedly used for pressure treatment, it does not lead to an increase in the viscosity of the liquid or generation of insoluble matters. As the polymerization mainly proceeds inside of the pressure treated wood, the composition of the treating liquid fixes well therein, and even if part of the liquid for pressure treatment exudes to the surface of wood, most of the polymerization has been already carried out inside of wood and a strong polymerization that would cause bonding of the wood with each other does not proceed anymore.

In addition, the solution of wood preservatives for pressure treatment is filled into the pores of the wood cells by impregnation, and then the filled solution is dried and condensed while the treated wood is dried and oxygen is provided at the same time. At this stage, the polymerization proceeds for the first time and, as a result, the composition of the treating solution fixes inside the pores of wood cells. This mechanism is different from that of an adhesive agent, and the present invention is an invention aimed at the improvement of wood itself.

Conradie describes a wood preservative including metallic soaps of long chain unsaturated fatty acids. The present invention which combines ligninosulfate and an enzyme having polyphenol oxidizing activity may further comprise various components conventionally

employed in wood preservatives. However, the present invention is not a simple combination of the wood-preserving compositions and a binder, as disclosed by Conrandie. The present invention was discovered based on the finding that only the technology of using ligninosulfate and an enzyme having polyphenol oxidizing activity can be applied to wood preservatives for pressure treatment among various conventional binding technologies, and that the technology of the present invention enables production of excellent pressure-treated wood products. Furthermore, the present invention discloses that more useful pressure-treated wood can be produced by further adding various compositions employed in wood preservatives. That is, the present method using an oxidizing enzyme and lignosulfonate enables fixing of, for example, a metallic soap compound disclosed by Conradie or known insecticide and/or fungicide more firmly inside of wood with the lignosulfonate polymerized by enzyme activity. Thus, a more excellent pressure-treated preserved wood can be obtained.

In the technological field of preserving wood, various technologies have been developed to solve the problem of leaching of the treating liquid impregnated into wood. The present invention is deemed to be a promising technology to cope with the problem.

In summary, the pressure treatment and bonding treatment of wood are different technological fields and the required properties for treating liquids are different. Accordingly, Haars and Schneider are directed to bonding (adhesive) treatment of wood, which is different from the present invention, which is directed to preserving wood.

In view of the above, the present invention is not taught or suggested by Haars, Schneider and/or Conrandie, and withdrawal of the foregoing rejection is respectfully requested.

II. Conclusion

Reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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